CUMULUS PYROXENE IN SHERGOTTY: THE DISCREPANCY BETWEEN EXPERIMENTAL AND OBSERVATIONAL STUDIES. Valerie P.S. Hale, Harry Y. McSween Jr., Dept. of Geological Sciences, University of Tennessee, Knoxville, TN 37996; Gordon McKay, SN4, NASA Johnson Space Center, Houston, TX 77058.

Several different techniques have been used to estimate the amount of cumulus, magnesian-rich pyroxene cores present in Zagami, with varying results. Knowing the amount of cumulus material is pertinent for determining the crystallization history of shergottites and the composition of the Martian magmas from which they formed. Experimental studies by [1] and [2] estimated the amount of cumulus pyroxene cores in Zagami to be 45% and 38% respectively, whereas observational studies have resulted in much lower values of 15-20% [3, 4]. While it is known that Zagami is heterogenous, these inconsistencies may be a result of inappropriate experimental conditions such as pressure. This study incorporates the use of elemental maps to test whether Shergotty shows a similar discrepancy.

Shergotty and Zagami are texturally and mineralogically similar; however, their experimentally determined proportions of cumulus pyroxene cores vary [1]. Stolper and McSween [1] performed melting experiments on these meteorites, and concluded that Zagami (BMNH) contains 55% intercumulus liquid, 23% cumulus augite cores, and 22% cumulus pigeonite cores. McCoy *et al.* [3] studied a different sample of Zagami (UNM). Using BSE maps, these authors concluded that only 15-20% cumulus pyroxene core is present. Trieman and Sutton [4] also studied the Zagami (UNM) sample. These authors applied distribution coefficients for minor and trace elements to mass balance calculations and determined that 20 ± 5% pyroxene cores are cumulus. Due to the contrasting results between the experimental and observational studies, McCoy and Lofgren [2] performed melting experiments on Zagami (UNM) under similar conditions to those of [1]. These authors concluded that 38% pyroxene core is cumulus, which is in better agreement with that of [1] than with [3] or [4].

Elemental maps of Shergotty (USNM 321-2) were created using the Cameca SX100 electron microprobe at NASA, Johnson Space Center. These images were then examined using the NIH-Image processing program which incorporates a color scale to determine modal percentages. A histogram across the diameter of individual pyroxenes can also be constructed, allowing for the amount of homogenous, magnesian-rich pyroxene cores to be calculated. When computing pyroxene modes, an amount comparable to that represented by cracks in the crystals was added to the total amount of pyroxenes. This was done only for the pyroxenes since they contain the majority of the cracks within the sample.

The results for Shergotty (USNM 321-2) are listed in Table 1. The proportion of cumulus pyroxene cores we obtained is significantly less than that determined experimentally by [1]. Those authors, in their melting experiments, calculated 11% cumulus augite cores and 17% cumulus pigeonite cores. In a point counting analysis of an experimentally produced sample, they calculated 69% total pyroxene, which is in close agreement with this study (63%), but they reported that augite and pigeonite are in equal proportions, based on one hundred random microprobe analyses. This study shows that pigeonite is more than twice as abundant as augite. The differences between the experimental and observational studies of Shergotty are similar to those for Zagami, and may suggest that the experimental studies [1,2] were not performed under conditions that simulated the rock's crystallization.

McCoy *et al.* [3] estimated an intercumulus liquid composition for Zagami by subtracting 10% each of pigeonite and augite core compositions from the bulk composition. A similar procedure was used to estimate the intercumulus liquid composition for Shergotty by subtracting 7.4% core augite and 6.4% core pigeonite from the bulk composition as reported by [6] (Table 2). The similarity in the estimated liquid compositions supports the idea that Shergotty and Zagami crystallized from the same melt. Variations in composition may be a result of local variation within the melt in the amount of pyroxenes (or other minerals) crystallized.

Our study reinforces conclusions previously reported for Zagami that there is a discrepancy between modally and experimentally determined cumulus pyroxene cores. Perhaps differences in pressure or other experimental conditions may account for this discrepancy.

Table 1. Comparison of modally and experimentally determined mineral abundances.

Shergotty Mode (vol. %)	**This Study**	**[Ref. 1]**
Augite (total)	20.3	48.0
(core)	7.4	11.0
Pigeonite (total)	43.0	52.0
(core)	6.4	17.0
Maskelynite	31.0	22.7
Whitlockite/Apatite	2.4	trace
Ilmenite/Titanomagnetite	1.8	2.8
Sulfides	0.3	0.2
Mesostasis	1.2	5.2

Table 2: Comparison of calculated intercumulus liquid compositions of Shergotty and Zagami. Shergotty intercumulus composition using the method of [3]: bulk composition of Shergotty [5]-6.4% core pigeonite composition [1]-7.4% core augite composition [this work]. Zagami intercumulus composition using bulk composition of Zagami-10% each augite and pigeonite core composition [3]. Experimentally determined intercumulus composition for Shergotty [1].

	Shergotty *[this study]*	**Zagami** *[Ref. 3]*	**Shergotty** *[Ref. 1]*
SiO2	50.8	50.7	50.1
TiO2	1.0	1.0	1.1
Al2O3	8.0	7.8	9.5
FeO	19.8	18.5	19.7
MnO	0.5	0.5	0.5
MgO	7.7	8.0	5.1
CaO	9.7	11.2	10.0
Na2O	1.5	1.6	1.8
K2O	0.2	0.2	0.3
P2O5	0.9	0.7	-

References. [1] Stolper and McSween (1979) GCA **43**, 1475-1498. [2] McCoy and Lofgren (LPSC XXVII, 840). [3] McCoy *et al.* (1992) GCA **56**, 3571-3582. [4] Treiman and Sutton (1992) GCA **56**, 4059-4074. [5] Burghele *et al.* (1983) *LPS*, **14**, 80-81.